Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Radiotherapy and Oncology 149 (2020) 104–106

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

COVID-19 Rapid Letter

Prevention and control measure to avoid cross infection during radiotherapy in coronavirus disease 2019 (COVID-19) epidemic in Wuhan, China ☆

Li Zhang [1], Zuan Zheng [1], Guangyuan Hu *, Xianglin Yuan *

Department of Oncology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

Since its large-scale outbreak began in December 2019, Coronavirus disease 2019 (COVID-19) has been led to a rapidly increasing number of confirmed cases, and has progressed now into an international pandemic. Across the globe, COVID-19 poses great threat to the health of patients of not only COVID-19 but also other diseases, such as cancer, diabetes, and chronic cardiovascular diseases.

Radiotherapy is one of the main treatment modalities in cancer management. Discontinuation of treatment would risk lowering its efficacy, which makes it critical to maintain the normal operation of the radiotherapy center, especially those in hospitals in high-risk areas.

In addition, protection from cross infection during radiotherapy sessions is of urgent significance for cancer patients. Compared with the general population, cancer patients are at higher risk of contracting COVID-19 and even developing critical symptoms because of weakened immune system [1,2]. In this letter, we propose a system of preventative measures to avoid cross infection, which were developed and implemented during the initial clustered COVID-19 outbreak here in Wuhan. Between Jan 1st and Mar 28th, 2020, when the outbreak was at its peak in the city, 679 patients received treatment in the Tongji radiotherapy (RT) center, only one of which was later confirmed to have contracted COVID-19, demonstrating the effectiveness of our measures. It is therefore our sincere wish to share the experience with the global community.

Upon arriving at the hospital, patients and RT staff go to a designated area for COVID-19 screening, which is consisted of routine blood tests, chest computerized tomography (CT), and RT-PCR test for COVID-19 nucleic acid [3]. Upon passing the screen, a patient is guided to register at the RT center and await further notice on the treatment date and time. A brief patient education session and an informed consent should be obtained to notify the risk of cross infection and corresponding preventative measures. Treatment booking needs to be precise down to the minute to minimize inter-patient interactions at the RT center, allowing for up to four patient appointments per hour.

For all corridors and passages, there should be only one point of entry and one point of exit. A patient can only enter after the previous patient has left the operating room. In addition, there should be a designated area for accompanying visitors during waiting.

It is advised that patients with the same site of irradiation receive treatment in the same linear accelerator (LINAC) and bundle together time slots for treating the same type of cancer. For instance, head and neck cancer patients are booked from nine to ten AM, and thoracic cancer patients from 11 to 12 AM. Also, care should be taken to separate the appointments for inpatients and outpatients.

Hand disinfection is performed upon entrance at the hospital. Patients should avoid conversations and gathering. In principle, family members are discouraged to enter the RT center.

Irradiation and facility disinfection should be timed properly. For instance, the treatment appointment should be accurately down to the minute, while irradiation room disinfection should be conducted every hour.

In general, the RT center can be divided into three types of zones based on level of contact with patients, namely the Clear Zone, Semi-clean Zone and Contaminated Zone.

Floor should be cleaned with 2000 mg/L Disinfectant. Frequency should be once every two hours. In the Contaminated Area, the radiotherapy Simulator, LINAC and accessories disinfection and sterilization, tables and chairs, doorknob, shielding door button, computer and laptop, mouse, keyboard control box, LINAC tabletop, all should be cleaned with 75% medical alcohol. Frequency should be once every two hours. Inside RT room ultraviolet (UV) radiation can be processed as a terminal disinfection method. In general, the effective distance of UV radiation is 2 m [4]. Therefore, we need to decide the quantity of ultraviolet radiator based on the

☆ The Editors of the Journal, the Publisher and the European Society for Radiotherapy and Oncology (ESTRO) cannot take responsibility for the statements or opinions expressed by the authors of these articles. Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds or experiments described herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made. For more information see the editorial "Radiotherapy & Oncology during the COVID-19 pandemic", Vol. 146, 2020.

* Corresponding authors at: Department of Oncology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China.

E-mail address: yuanxianglin@hust.edu.cn (X. Yuan).

[1] Contributed equally.

https://doi.org/10.1016/j.radonc.2020.04.011
0167-8140/

space/size of the room. Frequency should be once every two hours, 30 min each time (Fig. 1).

It is required recommended that patient and accompanying visitors wear a face mask through the hospital visit. In cases where patients have to take off the face mask during treatment, additional face shield must be placed properly. During irradiation, personalized preservative film and face shield may be needed. For example: before installing head and neck personalized immobilization mask, add face shield on the outside surface, which can be removed after positioning (Fig. 2).

All 679 patients were retrospectively enrolled between Jan 1st, 2020 and Mar 28th, 2020. The median age was 55 years (8–86). All patients were local residents of the major districts of Wuhan and most of the them were from Hankou, the starting point of outbreak, where the Huanan market is located. Among these 679 patients, lung cancer was the most frequent type of cancer (216, 31.8%), followed by ovarian cancer (76, 11.2%), esophagus cancer (61, 9.0%), liver cancer (57, 8.4%) and breast cancer (54, 8.0%).

Ten physicians and thirty-five technicians continued RT service during the outbreak, operating three LINACs. Before Jan 1st, 2020, one LINAC provided treatment for 80 ± 2 patients per day, whereas the number dropped by approximately 70% to 25 ± 3 afterwards.

Among the patients, only one infected in COVID-19 during the treatment. The patient was a 65 years old lady diagnosed with glioma (WHO grade III), and received adjuvant RT from Jan 22th 2020, when she was asymptomatic. On Feb 6th 2020, she tested positive by RT-PCR testing kit upon entrance, and also showed symptoms including fever. Based on her daily life and contact history, we thought the source of infection was in community. This patient was immediately transferred to a COVID-19 treatment facility. In our center, the two technicians who operated the LINAC where the patient previously received irradiation, along with three patients who were treated at that LINAC within the one-hour time slot as the COVID-19-positive patient, underwent isolation for 14 days at a designated isolation facility (Fig. 3). No other patients or staff was infected.

In addition, there was no incidence of cross-infection in the RT center during these two months. Four key points are noteworthy. First, the number of patients received radiotherapy should be strictly controlled, and patients should be allocated to be treated at the same LINAC and define different treatment time slots for different anatomy treatments. Second, patients should wear the mask during the treatment. If patients have to take off the mask during the treatment, additional face shield must be placed properly. Third, treatment room needs to be cleaned and disinfected using UV radiation. Frequency should be once every two hours, 30 min each time. Forth, once new COVID-19 cases (either suspected or confirmed) found, treatment should be stopped immediately. The other three patients and two technicians of the same LINAC at the same time slot were in isolation in special site for 14 days.

We are therefore confident that our system of protective measures, which employs patient screening, social distancing, regular

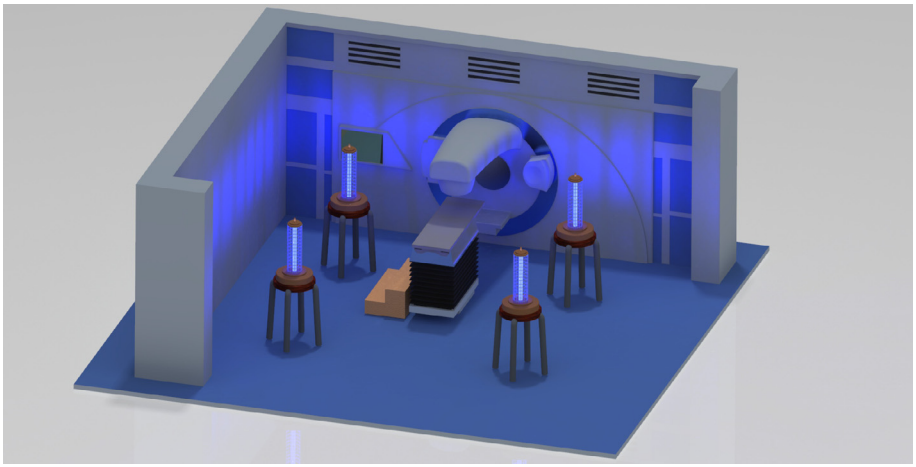

Fig. 1. Treatment room needs to be cleaned and disinfected using UV radiation, the effective distance of UV radiation is 2 m.

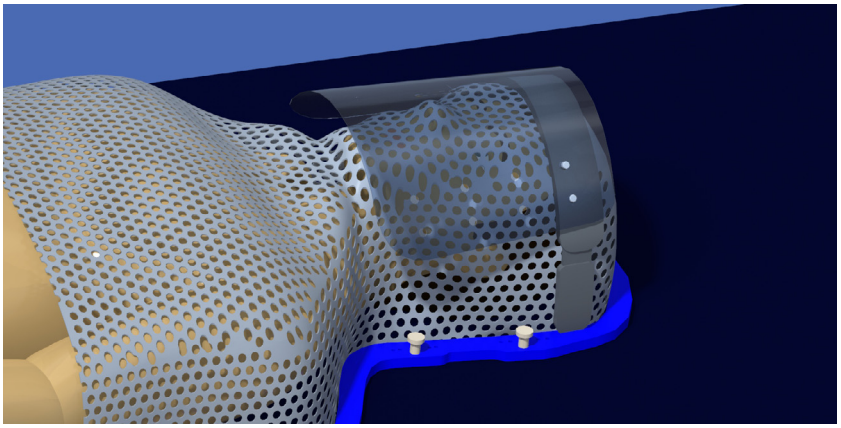

Fig. 2. Face shield for head and neck cancer patients, and the position can be adjusted according to field.

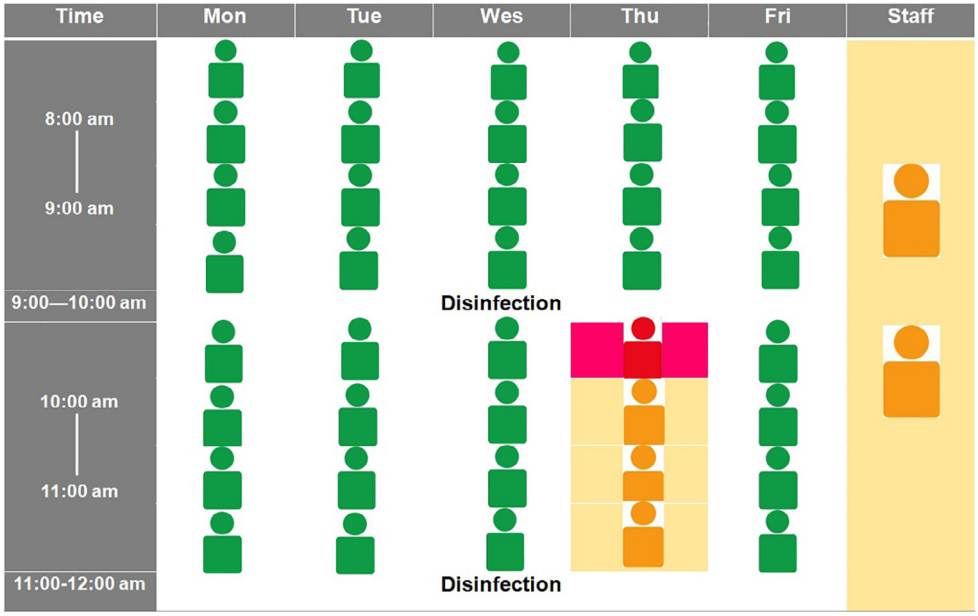

Fig. 3. Grid management for radiotherapy. Once new COVID-19 cases (either suspected or confirmed) found (red), treatment should be stopped immediately. The other three patients and two technicians of the same LINAC (yellow) at the same time slot were in isolation in special site for 14 days.

disinfection, and preventative isolation to block virus transmission, are effective in protecting both patients, stuff and public, and hopefully provide assistance to our colleagues currently battling COVID-19.

References

[1] Liang W, Guan W, Chen R, Wang W, Li J, Xu K, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. Lancet Oncol 2020;21 (3):335–7.

[2] Yu J, Ouyang W, Chua ML, Xie C. SARS-CoV-2 transmission in patients with cancer at a tertiary care hospital in Wuhan, China. JAMA Oncol 2020.

[3] National Health Commission of China. The diagnosis and treatment protocol for novel coronavirus pneumonia (interim sixth edition) [accessed 2020 Feb 18]. http://www.gov.cn/zhengce/zhengceku/2020-02/19/content_5480948.htm.

[4] National Health Commission of the People's Republic of China. Rules and Regulation of Medical Institutions environment cleaning and disinfection management. http://www.nhc.gov.cn/wjw/s9496/201701/0a2cf2f4e7d749aa920a907a56ed6890.shtml.